Kanazawa University

Let's open the door to research

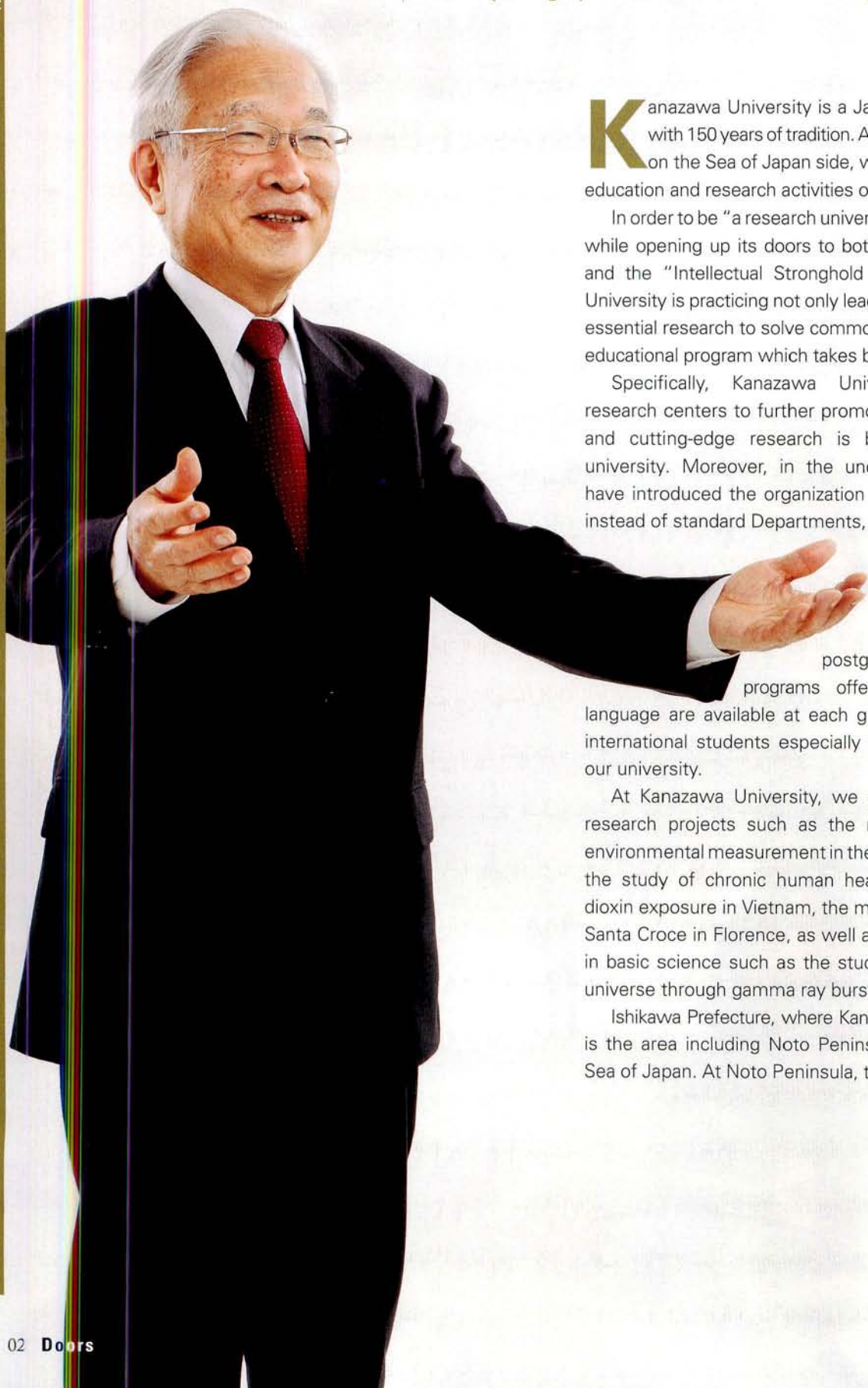
Doors

Introduction to Research Program

Message from the **President**

"Join Us and Study at the Intellectual Stronghold of East Asia"

A research university dedicated to education, while opening up its doors to both local and global society



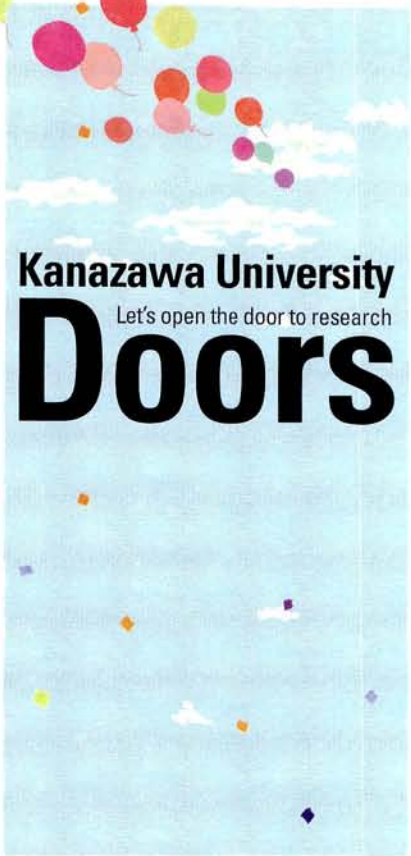
Kanazawa University is a Japanese national university with 150 years of tradition. As the fundamental university on the Sea of Japan side, we are positively developing education and research activities on the global stage.

In order to be "a research university dedicated to education, while opening up its doors to both local and global society" and the "Intellectual Stronghold of East Asia," Kanazawa University is practicing not only leading-edge research but also essential research to solve common problems in Asia and the educational program which takes both into account.

Specifically, Kanazawa University has established research centers to further promote unique research areas, and cutting-edge research is being undertaken at the university. Moreover, in the undergraduate program, we have introduced the organization by Colleges and Faculties instead of standard Departments, which allows our students to choose their majors while undertaking liberal arts soon after entering the university. In the postgraduate program, multiple programs offering degrees in English language are available at each graduate school, and many international students especially from Asia are studying at our university.

At Kanazawa University, we place emphasis on global research projects such as the restoration project of the environmental measurement in the Angkor ruins in Cambodia, the study of chronic human health conditions caused by dioxin exposure in Vietnam, the mural paintings of Basilica di Santa Croce in Florence, as well as leading-edge researches in basic science such as the study of the beginning of the universe through gamma ray burst.

Ishikawa Prefecture, where Kanazawa University is located, is the area including Noto Peninsula which juts out to the Sea of Japan. At Noto Peninsula, there is an on-going project



"*Satoyama Satoumi* Project" with the theme of sustainable social organization and regional regeneration. In this project, education and research programs are being conducted with a focus on the creation of regional coexistence with nature in cooperation with local organizations and businesses.

Approximately 60% of the world's population reside in Asia, and a great variety of ethnicities and nations exist here, along with resulting diverse cultures. Also, in this age of accelerating globalization, universities no longer exist only for their native countries. Kanazawa University is enforcing the human resource development and education and research function with focus on Asia which will become the world's center in near future, with the understanding that excellent human resources in East Asia are also excellent by global standards. As the "Intellectual Stronghold of East Asia," we gather people from not only within Japan but all over the world, and provide the atmosphere for healthy competition to nourish global human resource with the ability to solve various complicated problems.

Kanazawa is a "Historical City" nurtured by traditional culture. The city aims to become a "Global City" with distinctive brilliance in the world. Kanazawa is a city open to the world, and it is unique as well as intellectually stimulating. Kanazawa University is promoting global human resource development in this city. Come and research with us. We look forward to your decision.

中村信一

Shin-ichi Nakamura
President, Kanazawa University

Contents

Organization and History

Kanazawa University comprises 3 colleges, 16 schools, 5 graduate schools and 1 research institute, which are engaged in passing on history and tradition in a form fit for the future. In 2012, the university celebrates its 150th anniversary.

3 Colleges & 16 Schools

College of Human and Social Sciences
- School of Humanities
- School of Law
- School of Economics
- School of Teacher Education
- School of Regional Development Studies
- School of International Studies

College of Science and Engineering
- School of Mathematics and Physics
- School of Chemistry
- School of Mechanical Engineering
- School of Electrical and Computer Engineering
- School of Environmental Design
- School of Natural System

College of Medical, Pharmaceutical and Health Sciences
- School of Medicine
- School of Pharmacy
- School of Pharmaceutical Sciences
- School of Health Sciences

5 Graduate Schools

- Graduate School of Education
- Graduate School of Human and Socio-Environment Studies
- Graduate School of Natural Science and Technology
- Graduate School of Medical Sciences
- Law School

- University Hospital
- Cancer Research Institute
- University Library

Common Institutes for Education and Research
- Center for Regional Collaboration
- Advanced Science Research Center
- Information Media Center
- Foreign Language Institute
- Institute of Nature and Environmental Technology
- Research Center for Higher Education
- Environment Preservation Center
- Research Center for Child Mental Development

- Health Service Center
- Liberal Arts and Science Organization
- Organization of Global Human Resource Development
- Organization of Frontier Science and Innovation
- Organization of Global Affairs

Common Research Facilities
- Low Temperature Laboratory
- University Museum
- Center for Archaeological Research
- Technical Support Center

- Career Design Laboratory for Gender Equality

Hikoso Vaccination Center (1862)

Kanazawa Medical College (1879)

The Fourth Higher School (1894)

Ishikawa Teacher Training School (1874)

Kanazawa Technical College (1920)

Kanazawa University (May,1949)

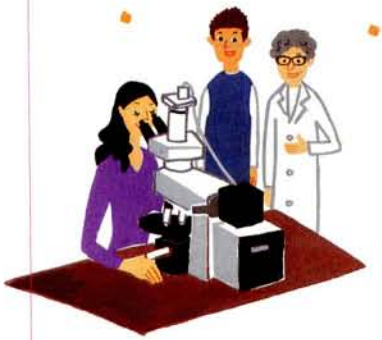
- The history of Kanazawa University can be traced back to the Vaccination Center established by the Kaga Clan in 1862. This makes Kanazawa the 3rd oldest national university.
- After absorbing a number of other institutions including Hikoso Vaccination Center, with their history and traditions, Kanazawa was inaugurated as a new university in May 1949.
- In April 2004, management was passed from the government to a National University Corporation, and the university set out on its path anew.
- In order to train outstanding people to meet the needs of society and to develop new academic fields to meet the need of the times, the university carried out reorganization and consolidation in April 2008, amalgamating 8 undergraduate schools and 25 courses into 3 colleges and 16 schools.
- In addition to the 3 colleges and 16 schools, the university currently comprises 5 graduate schools, the University Hospital, the Cancer Research Institute and so on.

Cutting-edge Research to Open Up the World

Kanazawa University, under the policy of "strengthening further its competitive research areas," implements intensive support for 5 research programs, which are introduced in *Research Project*.

These 5 programs are regarded as the prioritized research programs of the Organization of Frontier Science and Innovation, through which resource-intensive investment is being conducted. The organization also engages in strategic efforts to foster young researchers of future generations and provide support for obtaining large-scale competitive grants. Furthermore, the university presents a distinctive feature of its 3 institutions with 2 research centers established in each, in a bid to form an education and research center. These centers are introduced in *Research Center*.

Kanazawa University, in order to be the "Intellectual Stronghold of East Asia," promotes university-wide globalization to become a world-class education and research center through measures such as propelling the prioritized research programs and establishing centers in each institution. The university has engaged in a tireless effort for creation and reform, based on history and tradition, reviewing and reorganizing the university's structure toward enhancing the support system for education and research as well as strengthening the functions of the graduate schools.



Prioritized Research Programs

The first stage in brain science research combining the humanities and sciences

Innovative Brain Science for Development, Learning and Memory

Haruhiro Higashida
Program Leader

01

01-02 The Research Center for Child Mental Development is conducting a range of research to enhance their knowledge of developmental disorders.

02

Autism is one kind of developmental disorders. A congenital brain dysfunction, it is said to affect between 5 and 10 out of every thousand children born in Japan. Between 2004 and 2008, Kanazawa University worked to clarify children's social recognition through the 21st Century COE Program, Innovative Brain Science. As an extension of this program, the Research Center for Child Mental Development, established in 2007, is working to clarify the mechanism of childhood developmental disorders, especially autism. Professor Haruhiro Higashida, director of the center, has identified the relationship between the protein CD38 and childhood autism. CD38 promotes the secretion of the hormone oxytocin which gives rise to feelings of attachment and confidence. Professor Higashida inferred that autism sufferers, who have difficulty establishing relationships of trust, lack oxytocin, and in animal experiments using mice, he demonstrated that administration of oxytocin is effective in achieving the recovery of brooding behavior. Then, with the cooperation of families with autistic children, he found that administering oxytocin relieved the symptoms of autism in humans too.

Currently the Center is mapping the brain using a non-invasive measuring device called the magnetoencephalograph (MEG). With the cooperation of people from Kanazawa with children aged 3 and 4, they are using MEG to measure the magnetic fields that arise on the surface of children's brains. It is one of very few initiatives within Japan to quantitatively analyze the differences between the brains of normal and autistic children.

> "The Center is mapping the brain using a non-invasive measuring device called the magnetoencephalograph (MEG)"

This research involves more than brain and neuroscience, and clinical psychiatry. It also covers a wide range of fields including cognitive science, biology, philosophy and psychology. In order to train future researchers and instructors, Kanazawa University established a united graduate school with Osaka University and Hamamatsu University School of Medicine in 2009 and the school is now developing human resources.

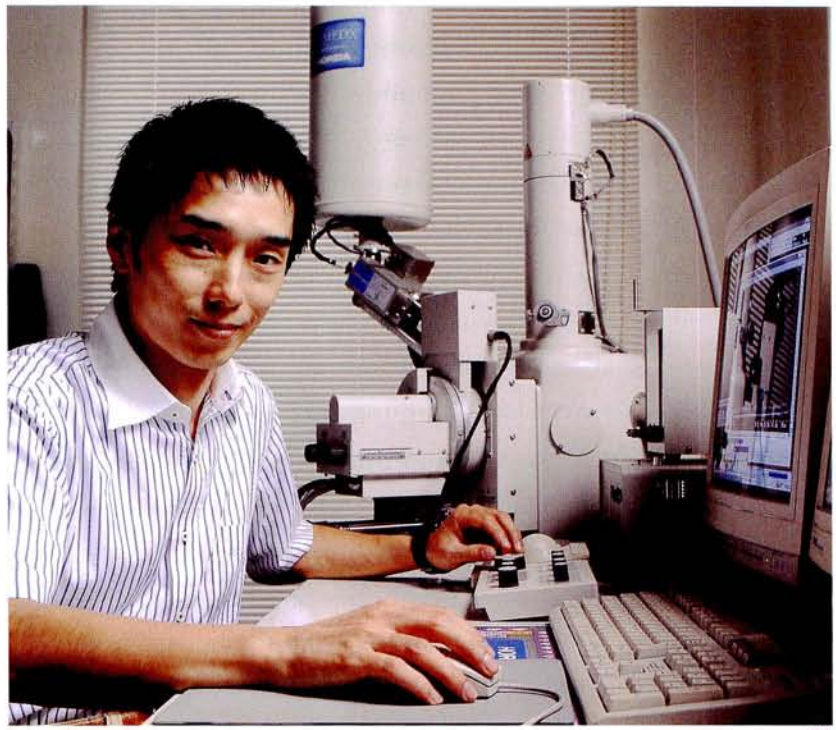
Predicting the future environment from aerosols and community woodland and coasts

Kazuichi Hayakawa
Program Leader

Environmental Linkage of Land, Sea, and Air over the Pan-Japan Sea Area

02

01 Associate Professor Atsushi Matsuki (Program Member)
02 The program team has established an observation site in Dunhuang, China to study the areas where yellow dust originates and where it settles.



01

> The place where the first arrival in Japan of these aerosols can be observed is the Noto Peninsula

Aerosols are tiny particles of liquids or solids that float in the air. One representative type is the yellow dust that is carried by the westerlies from the Eurasian continent. The place where the first arrival in Japan of these aerosols can be observed is the Noto Peninsula that juts out into the Sea of Japan. The Kanazawa University Noto Super Site comprising Kanazawa University, the *Satoyama Satoumi* Nature School (Suzu), the Marine Laboratory (Notocho), and the Atmospheric Monitoring Station (Wajima) monitors and analyzes the environment including the atmosphere, ocean currents, soil, and ecosystems using the rich natural environment of the Noto Peninsula.

Comprehensive knowledge of the natural sciences is crucial for observation of the environment. For example, it is known that yellow dust by nature is insoluble in water. However, when it comes into contact with atmospheric pollutants, sea spray and moisture from the sea, it becomes soluble. Nevertheless, there are still many questions remaining to be answered such as what impact this transformed yellow dust has in generating clouds and increasing or decreasing rainfall.

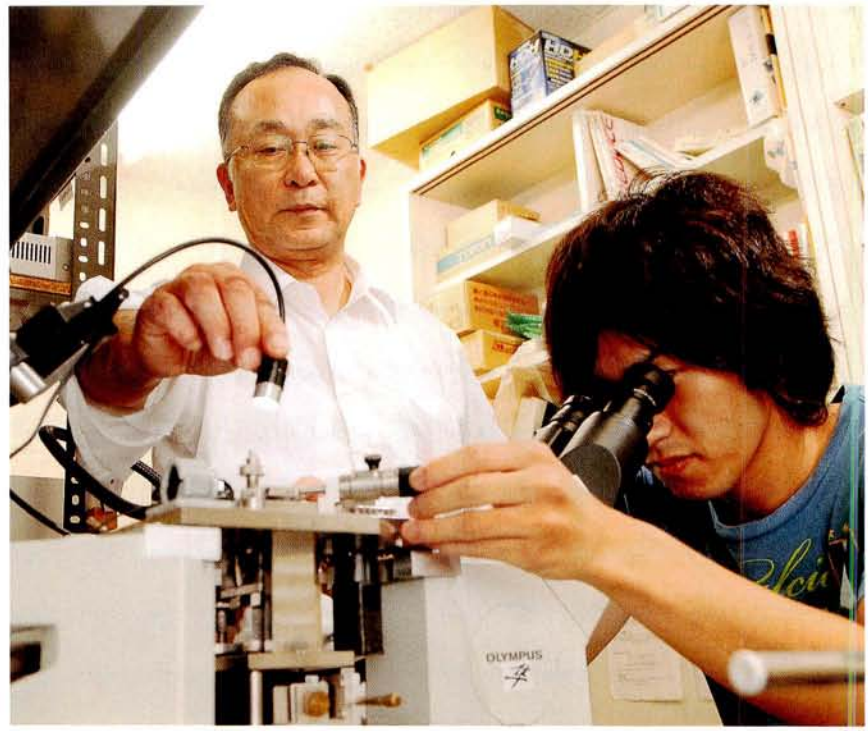
Furthermore, when considering environmental issues, it is also important to identify the special properties of each region. Despite the fact that East Asia including the region bordering the Sea of Japan is one of the world's main sources of aerosols, the number of observation facilities is insufficient. By analyzing the products adhering to the surface of the aerosols, it is possible to learn about various biochemical cycles from East Asia to the western Pacific Ocean. The results obtained from these observations are thought to be related to worldwide climate change and the global warming process. As such they are regarded with growing interest.

The project envisages creating an observation network for the Pan-Japan Sea area from the East China Sea to the Sea of Japan, with observation points at Miyakojima in Okinawa, Hedo-Misaki, and Fukuejima in addition to the Noto Peninsula, as well as establishing a network of cross-disciplinary researchers.

Creation of new life science areas based on the development of innovative measurement technologies and instruments

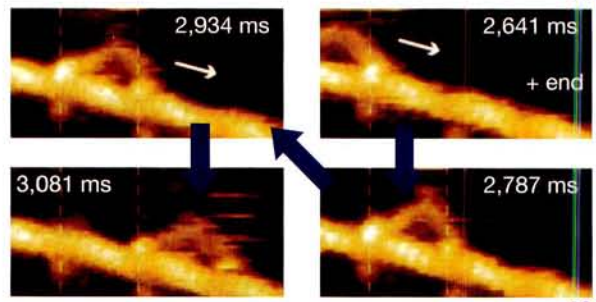
New Life Sciences Pioneered by Innovative AFM Technology

Toshio Ando
Program Leader



01

"High-speed AFM has the potential to transform life sciences and is expected to be widely exploited in the future."



02

01-02 The step size with which motor protein myosin V moves in cells is about 36 nm. The stepping behavior was observed for the first time using high-speed AFM.

Have you heard of the microscope that can capture dynamic images of the nanometer (1 billionth of a meter) world? The frontier Bio-AFM development project at Kanazawa University, "Creation of new life science areas based on the development of innovative measurement technologies and instruments," has developed the world's first microscope (high-speed AFM) that can observe moving molecules at the nanometer scale.

AFM stands for Atomic Force Microscope. It is a microscope that allows us to observe the three-dimensional structure of sample surfaces at the atomic level. Since it does not use electromagnetic force, insulating objects can be observed. Observing biological samples under their natural environment (i.e., in water) is also feasible, so it is widely recognized as a cutting-edge tool for life sciences.

Proteins operate dynamically. Directly observing the molecules as video images, rather than as still images, is therefore important for understanding their dynamic behavior. However, with conventional methods, the sample has to stay stationary to be observed. The structure of biological molecules has been obtained as still images, while the dynamics has been obtained through dynamic images of light spots emitted from fluorophores attached to the molecules. This means that the structure and dynamics have to be obtained separately. The present project has recently materialized the high-speed AFM system that breaks this limitation and can film biological molecules at the highest rate of 33 frames per second, 1,000-times faster than conventional AFM systems. Television images are produced at 30 frames per second, so the system can film images at temporal resolution equivalent to television. High-speed AFM has the potential to transform life sciences and is expected to be widely exploited in the future. The Bio-AFM Frontier Research Center, where the project is based and leading researchers with different backgrounds are brought together, is jointly conducting frontier research.

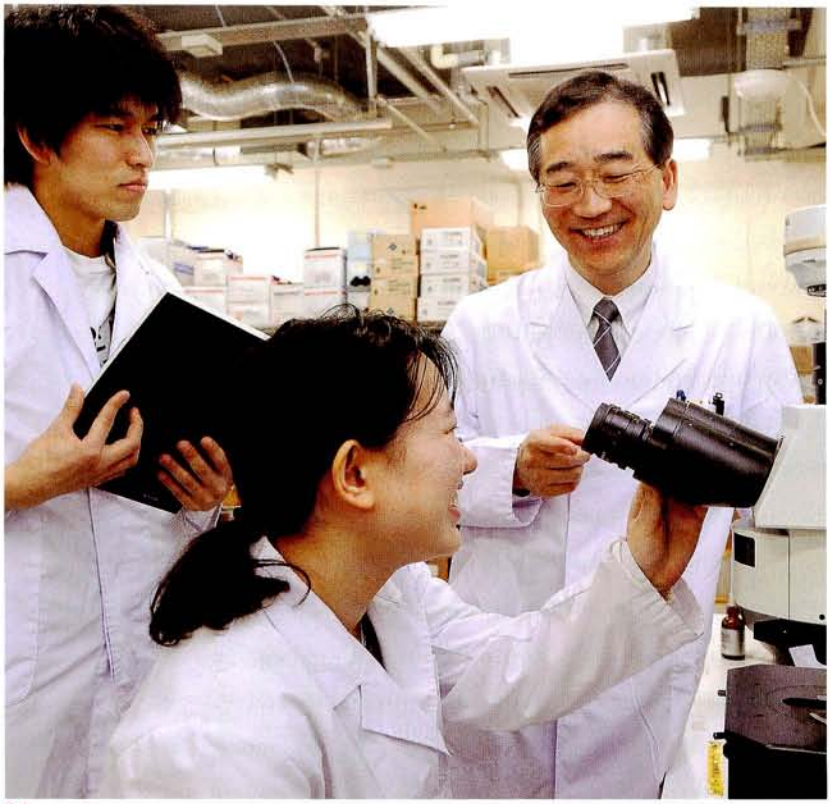
Demonstrating the connection between the nutrition metabolism of the liver and lifestyle-related disease

Shuichi Kaneko
Program Leader

Research on the Disturbance of Body Homeostasis by Nutrition, and the Regulation

01-02 Biochip analyzers lined up in the laboratory. They are investigating the regulatory mechanism of nutrition metabolism of the liver and the link between the liver and brain in nutrition metabolism.

02



01

> Our group discovered that selenoprotein P is expressed in large quantities in the livers of diabetics

In the 21st century, diets are becoming richer, especially in developed countries. However, new diseases such as obesity, diabetes, hypertension and dyslipidemia are becoming a problem. These diseases are called lifestyle-related disease. Nutrition metabolism plays a part, and especially fatty tissue has an impact here. Research on the Disturbance of Body Homeostasis by Nutrition, and the Regulation is a prioritized research program. It focuses on the connection between the nutrition metabolism function of the liver and lifestyle-related disease, seeking to clarify the pathogenic mechanism of lifestyle-related diseases. The program is also conducting research into new methods of diagnosis and treatment.

The liver is an organ which metabolizes nutrition such as sugars, fats, and protein, maintaining the nutritional level in the body at a constant rate. In other words, it functions to maintain homeostasis. However, consuming excessive nutrients can disrupt the functioning of the liver. Using comprehensive human gene analysis, Professor Shuichi Kaneko and his group discovered that selenoprotein P is expressed in large quantities in the livers of diabetics. Furthermore, in experiments with mice, the group discovered that selenoprotein P causes insulin resistance. This impairs the efficacy of insulin, a hormone that reduces blood sugar, thus making selenoprotein P a hormone that raises blood sugar levels. They named these types of hormones that originate in the liver as "hepatokine," and they proved that the liver is a contributing factor in lifestyle-related disease.

As an approach to preventive medicine, the group developed a biochip which has more than 100 small grooves, each containing DNA, RNA, amino acid and so on. When blood is poured over the chip, it is possible to simultaneously analyze how the substances in the blood react to the interactions. Although it has not reached the clinical stage, it is able to store and analyze a vast amount of data about the blood without having to remove a portion of liver tissue, which places a burden on the body. In this way, the group aims to establish methods for diagnosing lifestyle-related diseases.

Ocean drilling opens a new window to the earth

New Insights into the Earth's Interior through the 21st Century Mohole

Shoji Arai
Program Leader

> "Understanding the ocean floor and mantle greatly helps us to understand the circulation of material on a global scale."

01

02

01-02 A large outcrop of the Oman ophiolite, fossilized ocean floor from about 100 million years ago, from the vicinity of the boundary between the earth's mantle and crust.

The radius of the earth is over 6,000 km, but the only part of all that humankind has surveyed so far is the thin outer crust. The 21st Century Mohole Project is an international research project to clarify the structure of the earth from the crust to the top of its mantle, and the process of its formation. Professor Shoji Arai's science and technology research group at Kanazawa University is playing a central role in this project.

Mohole is a combination of the words "Mohorovičić discontinuity (Moho)" and "hole." The aim of the project is to drill a long hole with a length of 6 to 7 kilometers through the Moho, the boundary between the crust and mantle, observe the ocean floor and mantle directly, and collect material. The earth, which was formed 4.6 billion years ago, is gradually cooling, and as a result, the mantle inside the earth is circulating slowly by the convection which this causes. This movement has a profound relationship with phenomena occurring on the earth's surface. Ocean floor is formed where large amounts of magma are produced at the outlets of ascending currents of mantle convection. This then cools, becomes heavier, and sinks back into the earth, where island arcs such as the islands of Japan are formed, and give rise to crustal movements such as earthquakes. Understanding the ocean floor and mantle greatly helps us to understand the circulation of material on a global scale.

As preparation towards achieving the Mohole project, Professor Shoji Arai and his group are researching the ophiolite. Ophiolite is a rock suite from the uppermost mantle to the crust that was originally formed as the ocean floor and is now exposed on land by crustal movement. It is also referred to as "fossil ocean floor." Here it is possible to observe and collect ocean-floor crust and mantle material. The Oman ophiolite in the Arabian Peninsula is a representative example, and every year, they go there with students and conduct geological surveys and field exercises. Currently, candidate areas for the Mohole have been narrowed down to 3 places in the Pacific Ocean, and they are making further, closer investigation of the drilling sites and developing a proposal.

Mainstreaming *Satoyama* and *Satoumi* in research, education and regional collaboration towards the revitalization of Noto Peninsula

Satoyama Satoumi Project

Koji Nakamura
Project Representative

01 Paddy field excercise of Kakuma Satoyama Nature School in Kakuma Campus, Kanazawa University.
02 "One thousand paddies" at Shirayone, Wajima City, Noto Peninsula.

01

02

> Noto's *Satoyama* and *Satoumi* are rich in traditional culture and biodiversity

The importance of *Satoyama* and *Satoumi* landscapes in Japan has been emphasized as sustainable human-influenced natural environments (Socio-Ecological Production Landscapes, SEPL) through broader global recognition of their value (The International Partnership for the Satoyama Initiative, 2010). These biodiversity-rich landscapes have been formed through longstanding human-nature interaction. Changes in our lifestyle and industrial structure, however, have resulted in the depopulation and aging of the rural communities, which in turn led to the deterioration of the landscape due to underuse. The state of our *Satoyama* and *Satoumi* is the "inconvenient truth" behind Japan's rapid economic growth. It urges us to rethink our development trajectory and the role of academia in society as well.

The Project is a challenge as a regional university in bringing together local, regional and global actors in order to mainstream the *Satoyama* approach towards sustainable development. It is a meta-project that encompasses Kanazawa University's action plans; to become "a research university dedicated to education, while opening up its doors to both local and global society (2010)."

The Noto model for revitalization of rural communities

In 1999, the "Kakuma *Satoyama* Nature School" was launched to make the *Satoyama* in the Kakuma Campus of Kanazawa University available to the public for a lifelong learning project of the conservation of *Satoyama*. This Nature School is still going on supported by local volunteers and university members. However, they realize that the real *Satoyama* issue lay well beyond their campus walls, inseparable from economic reality. It is thus they thought to expand the mission to the Noto area.

Noto's *Satoyama* and *Satoumi* are rich in traditional culture and biodiversity. In June 2011, "Noto's *Satoyama* and *Satoumi*," one of the activities of the project, was designated as a site of Globally Important Agricultural Heritage Systems (GIAHS). The ecosystems of these landscapes are under threats from a shrinking rural population and an ageing society. They started the activities to conserve the rural landscape and biodiversity and to reactivate the local communities in the Noto area. In 2006, funding from the Mitsui & Co., Ltd. Environmental Fund enabled the establishment of the "Noto Peninsula *Satoyama Satoumi* Nature School" in the former Kodomari Elementary School building from Suzu-shi. These facilities are actively run as forums for exchange between the university and the region and for recreating *Satoyama* and *Satoumi*. "Noto *Satoyama* Meister Training Program" began in 2007, in which they train young professionals up to 45 years of age with the aim of preparing these individuals to start up environmentally-conscious agriculture, forestry, fishery and related businesses. They also run the "Noto Peninsula *Satoyama Satoumi* Activity (2009-)" to enlarge human exchange between urban and rural areas, and "Noto *Ikimono* Meister Training Program (2010-)" to educate the local people to develop skill in teaching the importance of biodiversity.

Growing Roster of 3 Colleges, 16 Schools, and 46 Courses

From admission to graduation, the new colleges allow students a high degree of freedom in selecting an approach toward achieving their goals. We offer you every opportunity to succeed in your studies.

College of Human and Social Sciences

Extensive research of human society through interdisciplinary approaches

http://www.kanazawa-u.ac.jp/e/academics/college/chss/

School of Humanities
http://jinbun.w3.kanazawa-u.ac.jp/english/

School of Law
http://www.law.kanazawa-u.ac.jp/school-of-law

School of Economics
http://econ.w3.kanazawa-u.ac.jp/e/

School of Teacher Education
http://www.ed.kanazawa-u.ac.jp/gr/e/

School of Regional Development Studies
http://chisou.w3.kanazawa-u.ac.jp/e/

School of International Studies
http://sis.w3.kanazawa-u.ac.jp/en/

College of Science and Engineering

Fostering creative and technical capabilities needed to contribute to society

http://www.kanazawa-u.ac.jp/e/academics/college/cse/

School of Mathematics and Physics
http://wwwhep.s.kanazawa-u.ac.jp/mathphys/e/

School of Chemistry
http://kohka.ch.t.kanazawa-u.ac.jp/22_chemistry/

School of Mechanical Engineering
http://www.me.se.kanazawa-u.ac.jp/e/

School of Electrical and Computer Engineering
http://www.ec.t.kanazawa-u.ac.jp/index.en.html

School of Environmental Design
http://www.ce.t.kanazawa-u.ac.jp/env_home/eng/

School of Natural System
http://natsys.w3.kanazawa-u.ac.jp/e/

College of Medical, Pharmaceutical and Health Sciences

Training medical experts in state-of-the-art methods and technologies and humanistic care

http://www.kanazawa-u.ac.jp/e/academics/college/cmphs/

School of Medicine (6-year course)
http://www.m.kanazawa-u.ac.jp/igaku/

School of Pharmacy (6-year course)
http://www.p.kanazawa-u.ac.jp/e/

School of Pharmaceutical Sciences
http://www.p.kanazawa-u.ac.jp/e/

School of Health Sciences
http://mhs3.mp.kanazawa-u.ac.jp/eng/

Stronghold of Intellect to Connect to the Future

The respective research organizations, in which numerous researchers work in cooperation and coordination, have established research centers to produce more significant research outcomes.

Topics

Postgraduate studies for advanced medical care and regional medical care

University Hospital

Katsuro Tomita
Director

02

01

01-02 The hospital promenade and a panoramic view of Kanazawa University Hospital.

> University Hospital has been providing patients with safe, high-level medical and nursing care

The basic policy of Kanazawa University Hospital is the "provision of high-quality medical care placing emphasis on humanity," fostering the medical care practitioners for the future of medical care," "research and development for the development of clinical medical development" and "contribution of regional medical care" based on the fundamental principle of "striving to foster superior medical care personnel displaying a depth of humanity, and providing high level medical care."

In January 2007, the University Hospital received designation as an all-prefectures cancer medical-examination cooperation base hospital from the Ministry of Health, Labour and Welfare to provide superior cancer treatment in cooperation with regional medical care facilities by carrying out a central cancer medical care role in Ishikawa Prefecture. Furthermore from June of 2008, the University Hospital has adopted a 7:1 nursing system to further improve the quality of nursing care. In May 2009, the outpatient treatment facility opened in which 3 areas, the central treatment facility, the outpatient care facility and the hospital wards are connected in a compact and functional floor structure centering on a hospital promenade which marks an improvement in convenience for patients.

The University Hospital was certified as Version 6.0 according to the hospital functional evaluation conducted by Japan Council for Quality Health Care in June 2010. This certification is proof that the University Hospital has been providing patients with safe, high-level medical and nursing care.

In January 2011, the University Hospital launched a high-level complete medical checkup (Premium Medical Check) service in collaboration with Kanazawa Advanced Medical Center. In addition to detecting illnesses through general checkups, medical specialists provide advice for health promotion and disease prevention to promote overall health maintenance.

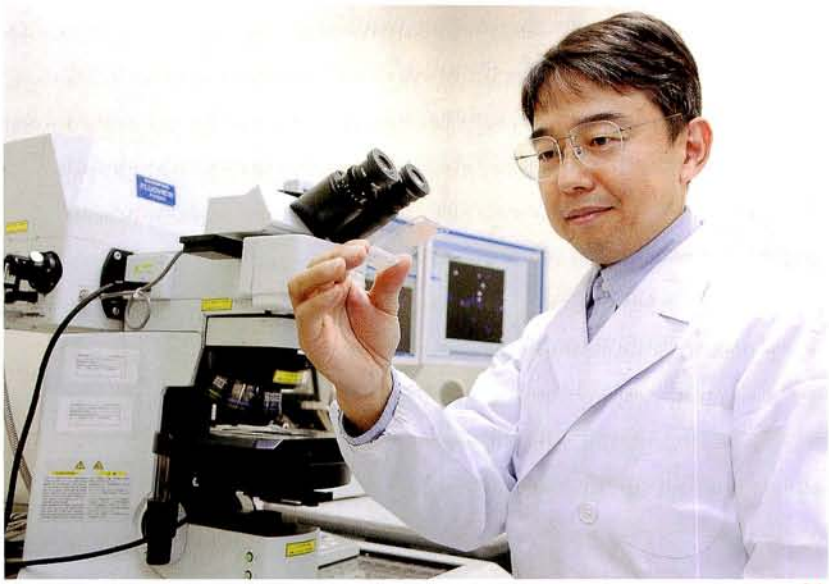
Furthermore, in the spring of 2013, the CPD (Continuing Professional Development) Center is scheduled for completion. In cooperation with Ishikawa Prefecture, it aims to train medical professionals, develop specialist ability, enhance life-long education and raise the level of medical care.

An advanced cancer research center, translating basic research to clinical practice

Naofumi Mukaida
Director

Cancer Research Institute

> Researchers from a variety of fields from clinicians to science and technology specialists are pursuing research at the Institute



01

01-02 In Division of Genetics, a genetically modified mouse carcinogenesis model was established and has contributed markedly to the research on gastrointestinal carcinogenesis with the use of a pathological and molecular biological approach.

02

Kanazawa University Cancer Research Institute was founded as the only cancer research institute of the Ministry of Education in 1967. Since then, in addition to contributing significantly to basic research, for example, the discovery of the proteinases involved in cancer metastasis, the Institute is working to develop anticancer agents.

Reflecting the intensification of cancer research, the Institute reorganized their research system into 4 programs in 2010, in order to conquer metastasis and drug resistance with an approach focused on cancer stem cells and the tumor microenvironment. In 2011, the Institute was authorized by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as the Joint Usage/Research Center on Metastasis and Drug Resistance.

Since the 1980s, cancer has become the leading cause of death for Japanese, and there is a growing call for efforts to translate the findings of basic research to diagnosis and therapy. In response to these social requirements, the Institute is undertaking multifaceted research. For example, the Cancer Stem Cell Research Program is energetically pursuing research down new avenues in various fields. In Division of Molecular Genetics, they are studying cancer stem cell maintenance mechanisms, in Division of Genetics, they are studying the interaction between tumor cells and the microenvironment, and in Division of Oncology and Molecular Biology, they are studying new pathways of carcinogenesis and metastasis.

Division of Molecular Virology and Oncology, Division of Molecular Bioregulation and others are working on the Cancer Microenvironment Research Program, which undertakes research focused on the environment surrounding cancer cells. In addition, the Cancer Molecular Target Exploration Program seeks to clarify the mechanisms of carcinogenesis at the molecular level while the Cancer Therapeutics Development Program aims to develop new anti-cancer treatments from the standpoint of clinical practice.

Researchers from a variety of fields from clinicians to science and technology specialists are pursuing research at the Institute. The Institute is equipped with automated cell sorters (automatic cell analysis and fractionation device), an X-ray CT machine for experimental animals, DNA sequencers, confocal laser scanning microscopes, as well as a high throughput screening system for anticancer agent development. The Institute is endeavoring to develop into an international center of excellence for malignant progression of cancer typified by metastasis and drug resistance.

Pursuing interdisciplinary research over a wide range of fields, with cooperation between the university and the regional society

Kimiko Takeda
Director

Center for Regional Studies,
Institute of Humanities and Social Sciences

01 A class on the Hokuriku regional economy course.
02 Regional survey in Suzu.

02

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The Center for Regional Studies was inaugurated in 2011 to address the various issues relating to the regional society and to make its findings available to the regional society. In order to respond promptly to the needs of the regional society, the Center tackles the human resource development with the staff for a wide range of interdisciplinary research. Moreover, the Center aims to function as a think tank by cooperating closely with local government, corporations and citizen activities. Whatever the issue, e.g. industrial or economic issue, regional revitalization, community regeneration and aging-depopulating problem, the Center is undertaking joint research in a wide range of areas such as economics, law, sociology and geography. The Center emphasizes interaction and development of human resource who can undertake highly adaptable interdisciplinary research, and the Center establishs a mechanism for making research findings directly available to the regional society through cooperation with local government, companies, NGOs and NPOs, and citizens.

> "We are undertaking joint research in a wide range of areas such as economics, law, sociology and geography"

In research investigation, the Center does not only provide the university's research findings unilaterally, but also cooperate with the regional society from the research stage, holding discussions with related organizations and associations and building networks. For example, the Center promotes cooperation between the university and regional society through the Research Project for Revitalization of Depopulated Areas to develop a comprehensive approach to revitalization and development strategies for depopulated areas. And the Research Forum on the Regional Policy of Hokuriku Area aims to form a research network in the Hokuriku area, in order to suggest more concrete and feasible regional policies.

In the Chiiki Shikojuku held at the Center to support and work with people outside the university, the Center offers courses and lectures that aim to increase public knowledge of unique history and characteristics of the Hokuriku area and to improve problem-solving skills. The Center offers a wide range of themes, from community businesses to renewable energy, considering how to create jobs and establish models for regional revitalization.

Rescuing endangered cultural heritages and giving them new values as "cultural resources"

Center for Cultural Resource Studies,
Institute of Humanities and Social Sciences

Haruya Kagami
Director

"The Center aims not only to protect and document these endangered cultural assets, but also to reinterpret them as cultural resources."

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01 Conservation of the site of Tikal, Guatemala.
02 Fostering the next generation of Wadaiko drum performers.

02

With economic development and advancing globalization, many tangible and intangible cultural assets around the world are in danger of disappearing. The Center for Cultural Resource Studies aims not only to protect and document these endangered cultural assets, but also to reinterpret them as "cultural resources" which create new values, carrying out various joint projects with overseas research institutions.

The Center is divided into 3 main divisions. The Division of Tangible Cultural Resources conducts research into tangible cultural resources such as archaeological sites, architecture, fine arts and crafts, conserving them and developing ways of putting them to practical use. They are carrying out joint projects around the world including Guatemala, Jordan, India, and Vietnam, cooperating in the construction of museums and archaeological parks and the management of world heritage sites. In addition, they seek ways to conserve cultural heritages in harmony with local communities, as the foundation for local identity or as tourist resources.

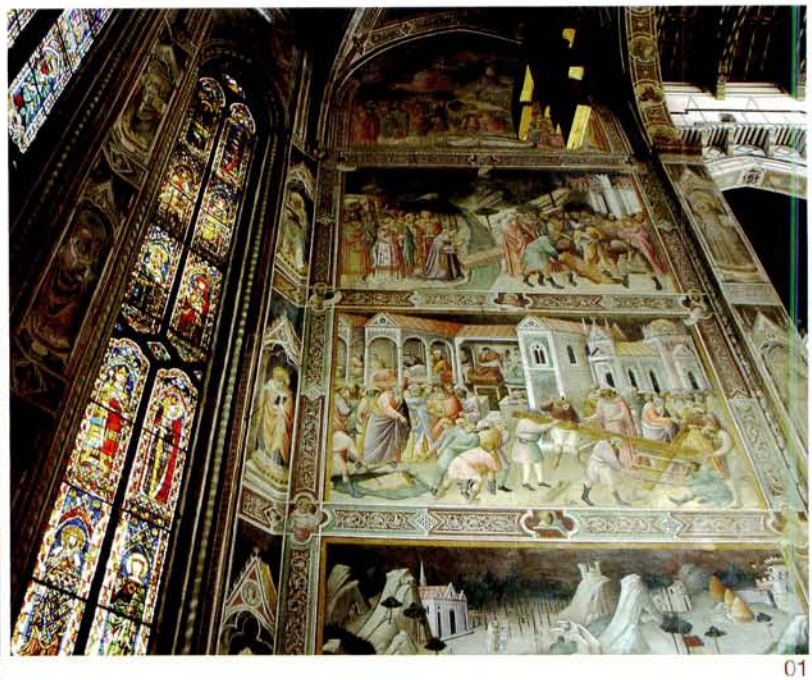
The Division of Intangible Cultural Resources conducts joint research with universities and research institutes in Asia and the rest of the world, studying intangible cultural resources such as performing arts, rituals, languages, and folk technologies, conserving them and developing ways of using them. Besides documenting and conserving disappearing intangible cultural assets, they propose ways to turn them into the wellspring of new cultural creativity, and to utilize them for revitalizing local communities.

The Division of Cultural Resource Information makes the findings of their research concerning cultural resources widely available, placing emphasis on promoting their general use. This includes publishing reports and texts, creating databases, training the next generation of people to manage cultural assets, and holding public lectures to explain the results of their fieldworks in an accessible manner. They also hold field schools and seminars as needed, and actively seek to develop personnel such as researchers and restoration specialists.

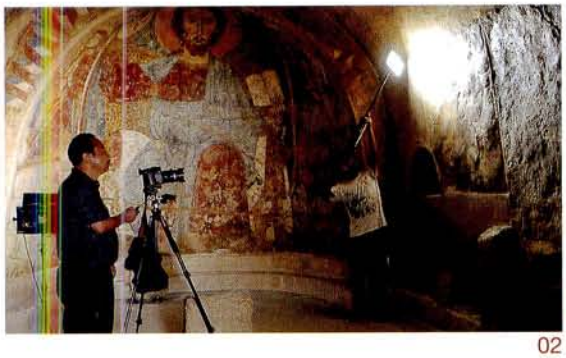
An international project formed collaboration with Italian Institutes on the restoration and study of Italian mural

Takaharu Miyashita
Director

Research Center of Italian Mural Paintings, Institute of Humanities and Social Sciences



01 "The Legend of the True Cross" painted in a chapel of the Basilica di Santa Croce.
02 They are conducting a multilateral analysis with the latest scientific technology to make the diagnosis and clarify their actual conditions.



02

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Research Center of Italian Mural Paintings conducts globally competitive research multidisciplinary. The Center aims to contribute to the conservation of world cultural heritage by developing novel technology for conservation and research of mural paintings, in partnership with Japanese/Italian academic institutions. The Center also plans to apply research achievements above to other studies or educational programs in future.

The Center was established by a project, a restoration project of the mural paintings in the Basilica di Santa Croce, which is known as the Temple of the Italian Glories, one of the World Heritages, situated in Florence, Italy. This is an international project in which a Japanese national university formed collaboration with Italian Institutes on the restoration and study of Italian mural for very first time. An Japanese donor had financed 200 million yen for the project. From 2004 to 2010, Kanazawa University led the project with the Opificio delle Pietre Dure di Firenze (the Laboratory of Restoration in Florence, Italy) and the Opera di Santa Croce (the Saint Cross Basilica in Florence, Italy). With the latest technologies they analyzed the series of mural paintings at the Basilica di Santa Croce, "La Leggenda della Vera Croce" (the Legend of the True Cross) by the 14th century painter Agnolo Gaddi, which is approximately 820 square meters large and is one of the largest frescos from 14th century in Italy, and accomplished fully restoration in 2010. Their research provided a new insight into its position in the art history and its interpretation also.

> "With the latest technologies we analyzed the series of mural paintings"

The next project has kicked off in 2010, which was funded not only by Kanazawa University but also by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), based at the research center of Kanazawa University, Japan, and also at the laboratory of restoration Florence, Italy. The Center continues to work in collaboration for another 4 years. This time they promote research and archive medieval mural paintings in South Italy, where less progress has been made in the restoration and the conservation of those paintings as compared with those in North Italy. They are conducting a multilateral analysis with the latest scientific technology to make the diagnosis and clarify their actual conditions. Eventually they are generating a highly accurate digital archive of their findings.

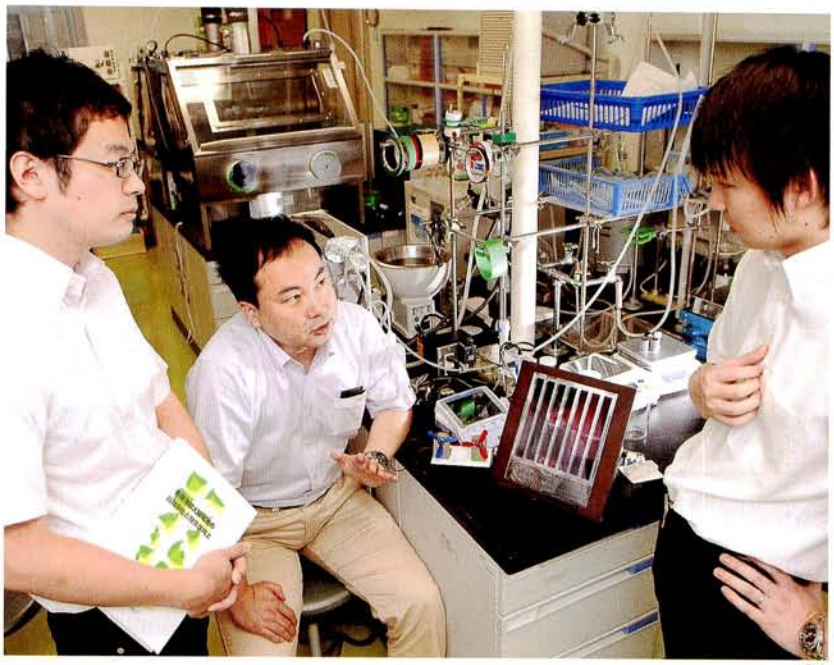
The Center publishes a newsletter twice a year, reporting their activities and achievement. They also have a website both in Japanese and English and update them accordingly.

Research and technology development towards local production and consumption of energy

Research Center for Sustainable Energy and Technology,
Institute of Science and Engineering

Kohshin Takahashi
Director

"It is certainly realistic to combine various forms of energy as social infrastructure"



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01-02 The purple flat panel to the front is the prototype module of the inverted organic thin film solar cell of the light transparent type, which has been developed by collaboration with Kanazawa University and companies.

The Great Eastern Japan Earthquake transformed Japan's energy situation. Nuclear power accounted for about 30% of the country's electricity supply, but the earthquake destroyed the myth that it was safe. How to generate energy and how to consume it is becoming pressing issues for the future.

The Research Center for Sustainable Energy and Technology (RSET) was established in 2011 as a center for researching sustainable energy. RSET's aim is to establish a society where energy is produced and consumed locally in each area, using renewable energy such as wind and solar power, and waste energy such as the biomass available in Hokuriku's rich natural environment. To achieve this, it is necessary to establish technologies for the efficient conversion, creation and reutilization of energy.

RSET comprises 5 divisions, Organic Thin-Film Solar Cells, Renewable Energy, Carbon Circulation Technology, Energy and Environmental Materials, and Unutilized Biomass Energy. Organic thin-film solar cells are cheaper, lighter and more flexible than current solar cells, making it possible to deploy them on a large scale, and also to build them into the bodies of cars. For example, the inverted thin-film solar cells developed by Kanazawa University display high durability and resistance to corrosion, and RSET is conducting research into materials and manufacturing processes that will improve the cells to the level of commercial application.

In addition, they are carrying out various research to establish wind power generation combined with small-scale hydropower and high performance biomass combustion systems, as well as marine biomass production processes using algal energy.

It is certainly realistic to combine various forms of energy as social infrastructure. The organic cooperation of the 5 divisions of RSET may in fact represent the ideal model for energy use in the near future.

Developing new methods of prevention and treatment for diabetes, hypertension, and other lifestyle-related diseases

Shuichi Kaneko
Director

Brain/Liver Interface Medicine Research Center,
Institute of Medical, Pharmaceutical and Health Sciences

"There is a growing interest in its connection with Alzheimer disease, metabolic syndrome"

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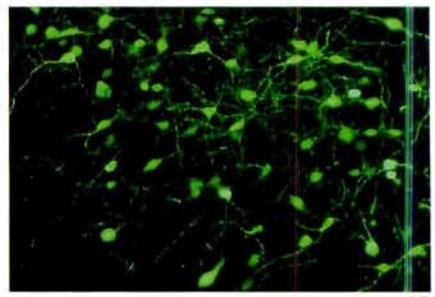

02

01-02 The Division of Molecular Neuroscience is committed to clarifying the profound relationship between the neurotransmitter orexin and sleep.

Japan is fast becoming a super-aging society. However, over the last half a century or so, the lifestyle of the Japanese has changed dramatically. There is a growing risk from lifestyle-related diseases such as diabetes due to inadequate exercise and changes in dietary habits. Recently, disease in maturity and old age is increasing while the causes and pathology are complicated, making it difficult to pin down with analysis of a single organ. Cross-disciplinary research that is expected to result in a breakthrough is becoming a matter of urgency.

The Brain/Liver Interface Medicine Research Center established in 2011 as a research institution that emerged from this background. The Center has 4 different divisions, Molecular Neuroscience, Environmental Response, Biological Regulation, and Life and Pharmaceutical. They work together to clarify mechanisms such as the interactions between organs such as the brain and liver, with the aim of developing new methods of preventing and treating lifestyle-related diseases.

For example, the Division of Molecular Neuroscience is committed to clarifying the relationship between the various functions conducted by the brain, such as sleep, arousal and eating behavior, and their malfunction. Professor Takeshi Sakurai, the head of the division, was a key person in the sleep research which clarified the profound relationship between the neurotransmitter orexin and sleep. Sleep is extremely important to physical and mental health, and there is a growing interest in its connection with Alzheimer disease, metabolic syndrome and so on.

The Division of Environmental Response is working to identify the impact of overnutrition and other daily habits on the metabolism and phenotypic expression of various organs. They received the Minister of Education Award for development of the interferon reaction chip that predicts the interferon effect of chronic hepatitis C.

The Ministry of Health, Labour and Welfare estimates that there are 22.1 million diabetics nationwide, including patients with mild cases. Establishing methods of prevention and treatment for these diseases is becoming a pressing issue.

Developing wellness promotion on a scientific basis

Wellness Promotion Science Center,
Institute of Medical, Pharmaceutical and Health Sciences

Shigeki Ohtake
Director

"Wellness promotion science is a field of study that focuses on extending "healthy longevity"

01

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01-02 In the Health Consulting Division, nurses, public health nurses, occupational therapists, and physical therapists are performing health consultation.

Is there anybody who doesn't want to lead a healthy life? In order to enable people to fulfill the wish to live in health, Wellness Promotion Science Center is working with the community to develop wellness promotion science to support healthy behavior with a scientific basis.

Wellness promotion science is a field of study that focuses on extending "healthy longevity," the period during which people can lead independent lives, while healthy in mind and body. It is a new concept that goes beyond the boundaries of conventional preventive medicine. The Center aims to establish EBW (Evidence Based Wellness) as a methodology for defining and verifying health scientifically, and for maintaining and improving health in accordance with the person's age and physical state. Through cooperation with national, public and private universities, local governments, and medical institutions, they will establish a new field of study for promoting health that goes beyond disease prevention and to create an associated education and research center.

The Health Monitoring Division is researching methods for evaluating health scientifically using advanced equipment such as magnetic resonance imaging (MRI) machines. They are making these into more accessible methods of measuring health while validating its appropriateness, and they aim to establish new health indices.

The Health Consulting Division established the Ishihiki Yorozu Health Office to establish wellness promotion science rooted in the community and they are visiting community centers and other community locations to conduct health consultations and various physical measurements. They hope to include the findings in the textbook Health Management Science and Technology used for postgraduate education.

In this way, the Center is pursuing various research activities to sublimate the hitherto vague concept of health promotion into positive health for the community with a sound scientific basis. If they can achieve a template for wellness promotion science here, they can take it nationwide. The day may not be far off when science originating from Kanazawa contributes to health across Japan.

5 Graduate Schools and 28 Divisions

Over 800 students are admitted each year to the graduate schools of Kanazawa University. We offer graduate degrees in 28 Divisions in 5 Schools.

Graduate School of Education (Master's Course: 2 years) http://www.ed.kanazawa-u.ac.jp/di/e/		
Division	Division of Advanced Educational Research and Development	

Graduate School of Human and Socio-Environmental Studies (Master's Level Section of Integrated Course: 2 years) http://human-socio.w3.kanazawa-u.ac.jp/en/		
Divisions	Division of Humanities	
	Division of Law and Political Science	
	Division of Economics	
	Division of Regional Development Studies	
	Division of International Studies	

Graduate School of Human and Socio-Environmental Studies (Doctoral Level Section of Integrated Course: 3 years) http://human-socio.w3.kanazawa-u.ac.jp/en/		
Division	Division of Human and Socio-Environment Studies	http://human-socio.w3.kanazawa-u.ac.jp/en/doctor/index.html

Graduate School of Natural Science and Technology (Master's Level Section of Integrated Course: 2 years) http://www.nst.kanazawa-u.ac.jp/eng/master/	
Divisions	Division of Mathematical and Physical Sciences
	Division of Material Chemistry
	Division of Mechanical Science and Engineering
	Division of Electrical Engineering and Computer Sciences
	Division of Environmental Design
	Division of Natural System

Graduate School of Natural Science and Technology (Doctoral Level Section of Integrated Course: 3 years) http://www.nst.kanazawa-u.ac.jp/eng/doctor/	
Divisions	Division of Mathematical and Physical Sciences
	Division of Electrical Engineering and Computer Science
	Division of Innovative Technology and Science
	Division of Material Sciences
	Division of Environmental Science and Engineering
	Division of Life Sciences

Graduate School of Medical Sciences (Master's Course: 2 years) http://www.m.kanazawa-u.ac.jp/eng/	
Division	Division of Madical Sciences

Graduate School of Medical Sciences (Doctoral Course: 4 years)		
Divisions	Division of Neuroscience	http://www.m.kanazawa-u.ac.jp/eng/
	Division of Cancer Medicine	http://www.m.kanazawa-u.ac.jp/eng/
	Division of Cardiovascular Medicine	http://www.m.kanazawa-u.ac.jp/eng/
	Division of Environmental Science	http://www.m.kanazawa-u.ac.jp/eng/
	Division of Pharmacy	http://www.p.kanazawa-u.ac.jp/e/

Graduate School of Medical Sciences (Integrated Course of Master's Level: 2 years, Integrated Course of Doctor's Level: 3 years)		
Divisions	Division of Pharmaceutical Sciences	http://www.p.kanazawa-u.ac.jp/e/
	Division of Health Sciences	http://mhs3.mp.kanazawa-u.ac.jp/eng/division/

Law School (Professional Degree Course: 3 years) http://www.jd.kanazawa-u.ac.jp/	
Division	Division of Legal Affairs

Global Access

Japan in the World

Japan is situated in northeastern Asia between the North Pacific Ocean and the Sea of Japan. Japan has a total landmass of 377,873 square kilometers, which is nearly equivalent to German and Switzerland combined or slightly smaller than California. Japan consists of 4 major islands that are surrounded by more than 4,000 smaller islands.

Kanazawa in Japan

Kanazawa is located in the center of the country on the Sea of Japan. Kanazawa allows for easy access to Japan's 3 largest cities, Tokyo, Osaka, and Nagoya.

Access to Kanazawa

From Tokyo

Fly to Komatsu Airport (1 hr.), and take a shuttle bus to Kanazawa Station. There are direct flights from Tokyo (Narita/Haneda) Airport to Komatsu.
By train, take JR train from Tokyo Station to Kanazawa Station (3hrs. 35min.).

From Osaka

Take JR train to Kanazawa Station (2hrs. 40min.).

Outside view of
21st Century Museum

Higashi Chaya Area

Snowscape in Kenrokuen Garden

Photo credit: Kanazawa City

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